A RETROSPECTIVE STUDY ON PENETRATING INJURIES ABDOMEN

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CERTIFICATE

This is to certify that **" A RETROSPECTIVE STUDY ON PENETRATING INJURIES ABDOMEN"** is a bonafide work done by **Dr S. SAVITHA**, post graduate in department of **General Surgery , Kilpauk Medical College , Chennai -10** under my guidance and supervision in fulfillment of regulation of **The Tamilnadu Dr .M.G.R. Medical university** for award of **M.S . Degree Branch 1 , Part 11 (General Surgery)** during academic period from **March -2007** to **March -2010.**

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INTRODUCTION

INTRODUCTION

Penetrating abdominal injuries forms an important component of surgical emergencies. It remains one of the commonest reasons for preventable deaths in any trauma systems. (1).

Penetrating abdominal injuries were managed expectantly until late 19th century. Over the past century great advances were made in the management of such injuries. Major improvements in the field of blood transfusion and liberal use of antibiotics lead to the increase in explorative laparotomy.

Abdomen occupies a vulnerable position in human anatomy and is the least protected and most susceptible part for accidental and homicidal injuries.

Abdominal injuries may be parietal or visceral or perforating through and through injury. Unnecessary exploration leads to increased morbidity. The goal in managing penetrating abdominal injuries is to identify and treat all the damages caused by the weapon and to reduce negative laparotomy and avoid missed injuries.

AIM OF THE STUDY

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1) To evaluate the efficacy of computed tomography in identifying peritoneal breach and visceral injuries in penetrating abdominal injuries.
2) To identify the factors or issues that helps in reducing the morbidity in penetrating hollow viscus injuries.
3) To evolve a better protocol in managing hollow viscus injury following penetrating abdominal trauma with the experiences gained in this retrospective study.

MATERIALS AND METHODS

MATERIALS AND METHODOLOGY

This is a retrospective study that was carried out in Government Kilpauk Medical College and Government Royapettah Hospital from May 2007 to July 2009.

From the hospital database 53 cases admitted with abdominal penetrating injury were included in this study. The patient charts were reviewed for demographic data, type of injury, symptoms and signs at presentation, methods of diagnostic investigations, treatment adopted and complications encountered.

Those patients who were stable at the time of presentation were selected and subjected to CT scan. Intra abdominal CT was performed within 2 hours after initial assessment and resuscitation. Axial scans with 1 cm cuts were taken from diaphragm to femoral heads after infusion of Hypaque contrast after a delay of 70 seconds. Oral and rectal contrast was also given. The CT scans were reviewed by radiologists.

Radiographic signs considered as positive were pneumoperitoneum, hemoperitoneum, wound track extending through the peritoneum, and signs of bowel injury were: wound track extending to bowel wall, bowel wall defect, bowel wall thickening, extravasation of oral or rectal contrast, and focal hematomas.

The following data were noted

AGE GROUP AFFECTED

Incidence of penetrating abdominal trauma in various age groups:

AGE	No. of cases	Percentage
0—10	**1**	**2**
11—20	**4**	**8**
21—30	**20**	**37**
31—40	**22**	**42**
41—50	**5**	**9**
>50	**1**	**2**
Total	**53**	**100**

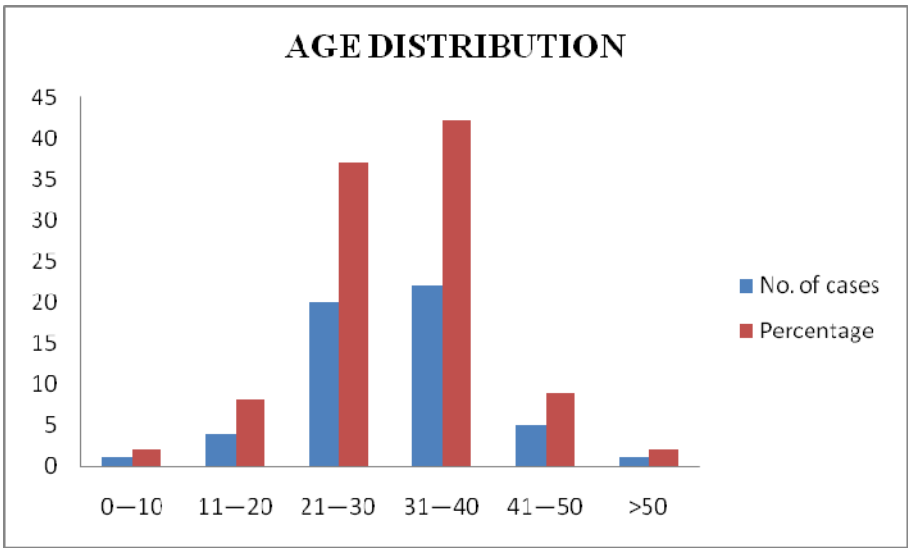
Nearly 80% of cases were in the age group of 20 to 40 years.

SEX INCIDENCE

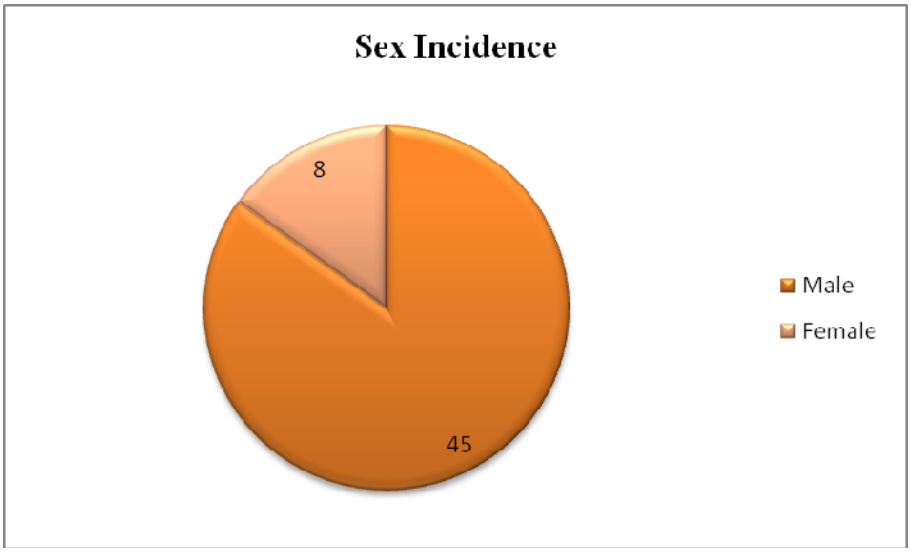
Sex	No. of cases	Percentage
Male	**45**	**85**
Female	**8**	**15**
Total	**53**	**100**

Of the 53 cases 45 were males and 8 were females.

AGE DISTRIBUTION



SEX INCIDENCE



WEAPONS USED IN PENETRATING INJURY ABDOMEN

Weapons	No. of Cases	Percentage
Knife	**43**	**81**
Broken Bottle	**7**	**13**
Iron Rod	**2**	**4**
Gun Shot	**0**	**0**
Bull gore	**1**	**2**
Total	**53**	**100**

CAUSE OF INJURY

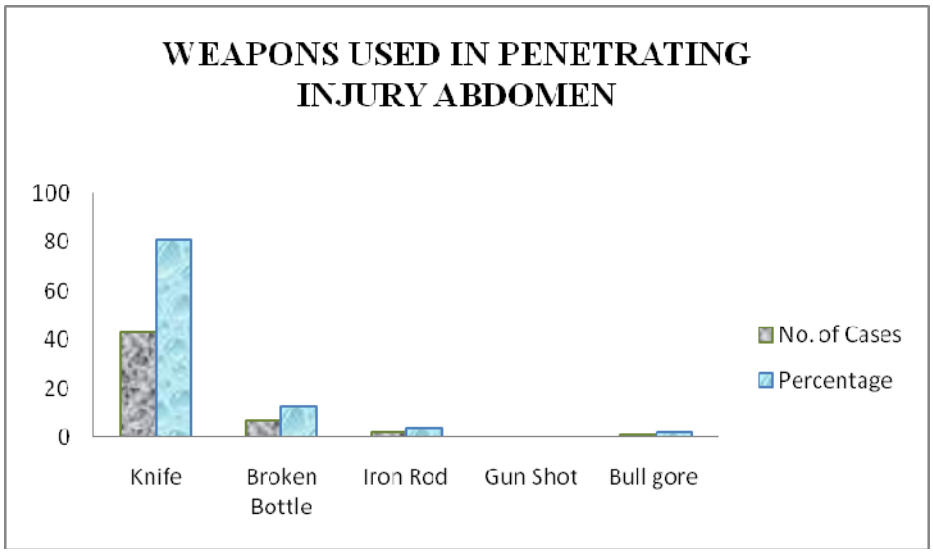
Cause	No. of patients	Percentage
Assault	**46**	**87**
Accident	**4**	**8**
Iatrogenic	**1**	**2**
Self inflicted	**2**	**4**

Homicidal stab injury with knife was the commonest mode of penetrating abdominal injury encountered in this study.

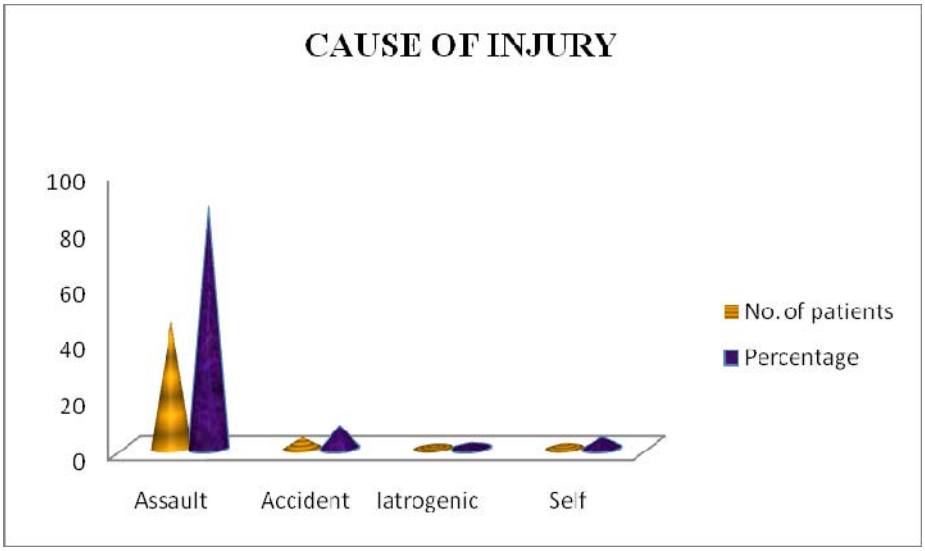
Out of 53 patients, 8 patients were immediately planned for early mandatory laparotomy. All these patients presented with either one of these findings: generalised peritonitis, or evisceration or hemodynamic instability. They were not subjected to other forms of investigations like CT abdomen. Exploratory laparotomy was done.

WEAPONS USED IN PENETRATING INJURY

ABDOMEN



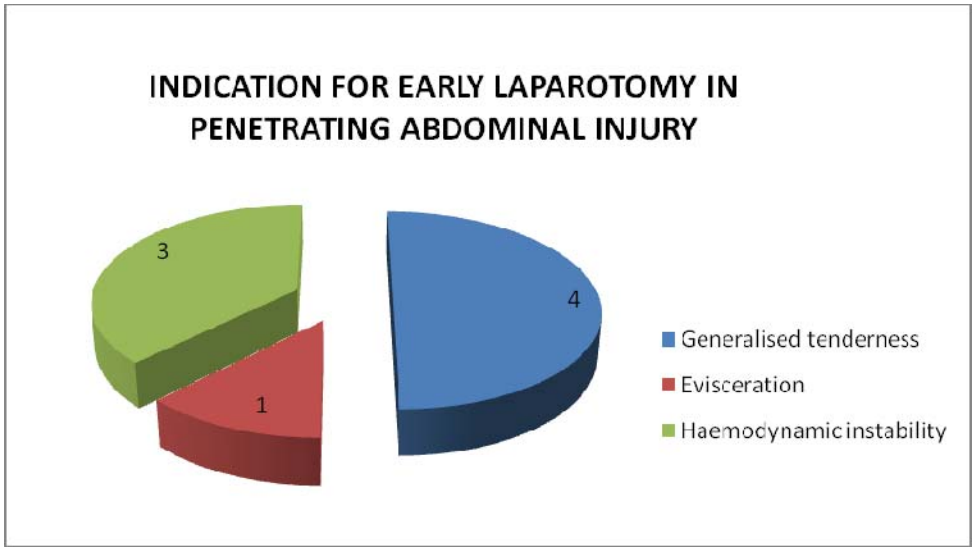
CAUSE OF INJURY



INDICATION FOR EARLY LAPAROTOMY IN PENETRATING ABDOMINAL INJURY

Indication	No. of patients	Percentage
Generalised tenderness, guarding and rigidity	4	8
Evisceration	1	2
Haemodynamic instability	3	6
Total	8	16

The remaining 45 patients were stable and were not showing any signs for immediate mandatory laparotomy. They were subjected for CT abdomen with contrast study to identify peritoneal breach and other internal organ injuries.

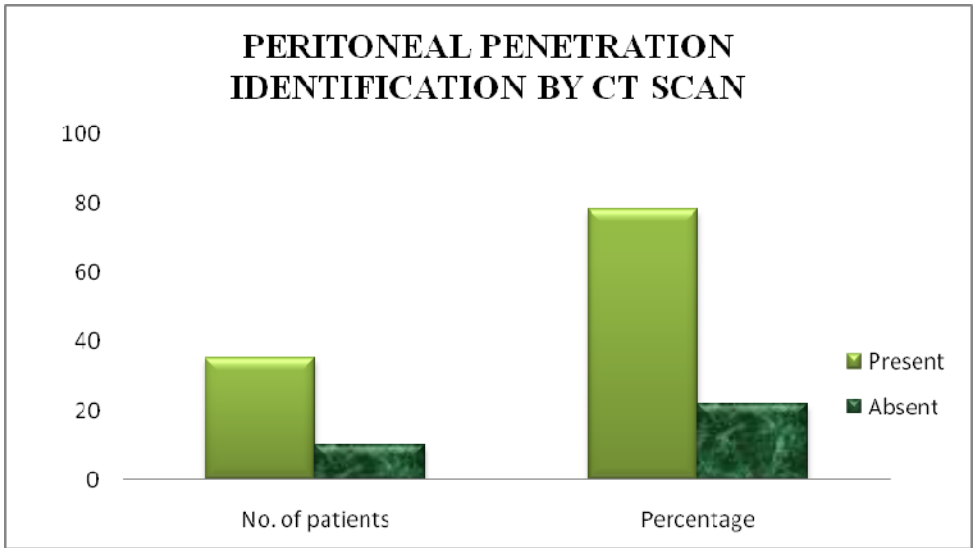


PERITONEAL PENETRATION IDENTIFICATION BY CT SCAN

Peritoneal penetration	No. of patients	Percentage
Present	**35**	**78**
Absent	**10**	**22**
Total	**45**	**100**

Out of 45 patients, 35 patients were showing evidence of peritoneal penetration in the form of free air in the peritoneum with or without positive CT findings of visceral injuries.

10 patients did not have peritoneal breach. These patients were discharged safely after an over night observation.

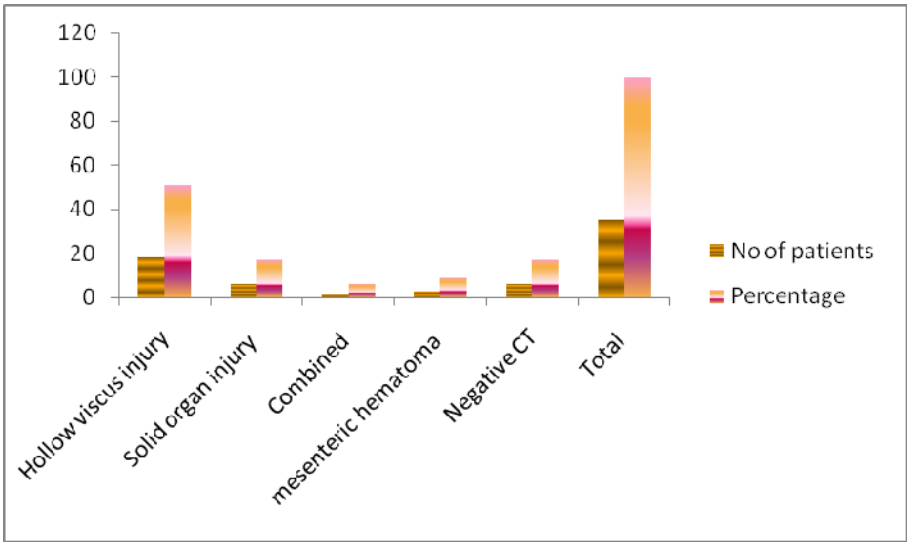


IDENTIFICATION OF INJURIES BY CT SCAN

The initial CT demonstrated visceral injuries in 29 patients out of 35. In the remaining 6 patients CT does not show any findings.

Injuries identified by CT scan	No of patients	Percentage
Hollow viscus injury	**18**	**51**
Solid organ injury	**6**	**17**
Combined	**2**	**6**
Minimal hemoperitoneum / mesenteric hematoma	**3**	**9**
Negative CT	**6**	**17**
Total	**35**	**100**

Out of this, hollow viscus injury was present in 51% of cases.



RATIO OF OPERATIVE TO CONSERVATIVE TREATMENT

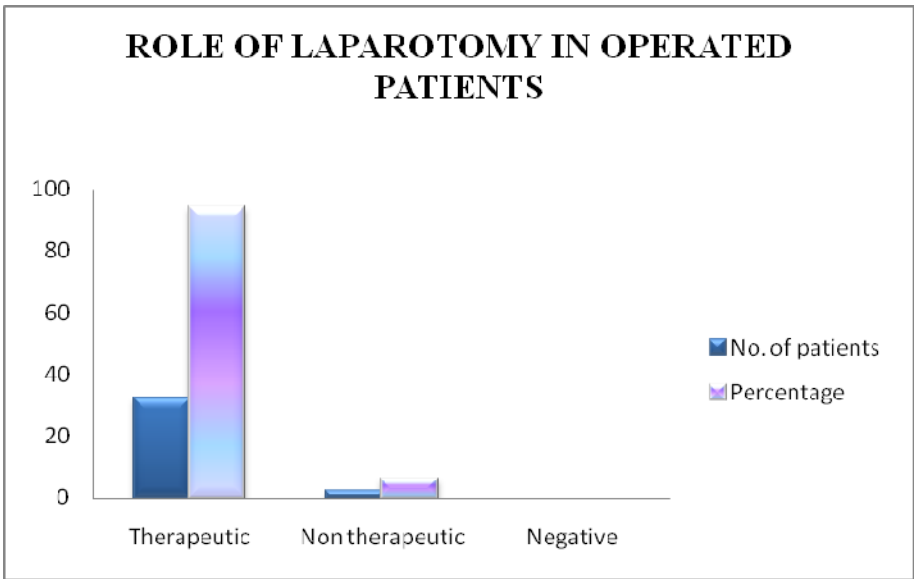
Treatment offered		No. of patients		Percentage
Operated	Early laparotomy	34	8	64
	Laparotomy after CT scan		24	
	CT negative		2	
Conserva-tive	No peritoneal breach	19	10	36
	No injuries detected		4	
	Minor injuries		5	
Total		53		100

After detailed clinical evaluation and suitable investigation, 34 patients were offered exploratory laparotomy. These patients include those with peritoneal peritonitis, evisceration, haemodynamic instability, and with CT scan of the abdomen showing significant solid organ injuries or hollow viscus injuries. Only one patient who was treated initially with conservative management later required laparotomy due to the development of peritonitis.

ROLE OF LAPAROTOMY IN OPERATED PATIENTS

Laparotomy	No. of patients	Percentage
Therapeutic	**32**	**94**
Non therapeutic	**2**	**6**
Negative	**0**	**0**
Total	**34**	**100**

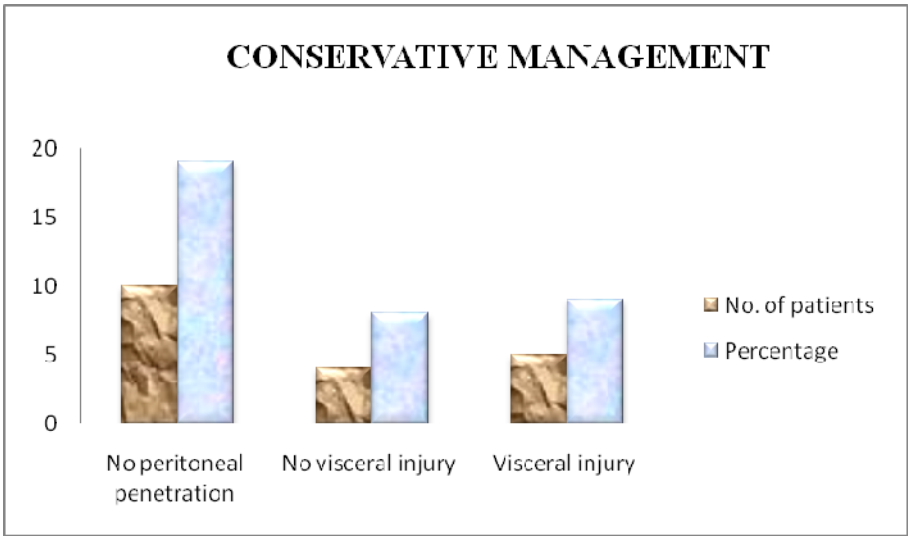
Of these 34 patients who underwent exploratory laparotomy, 32 underwent therapeutic laparotomy and 2 patients had non therapeutic laparotomy.



CONSERVATIVE MANAGEMENT

Conservative	No. of patients	Percentage
No peritoneal penetration	10	19
No visceral injury	4	8
Visceral injury	5	9
Total	19	36

In the hollow viscus injuries, following findings were observed in the study.



STOMACH

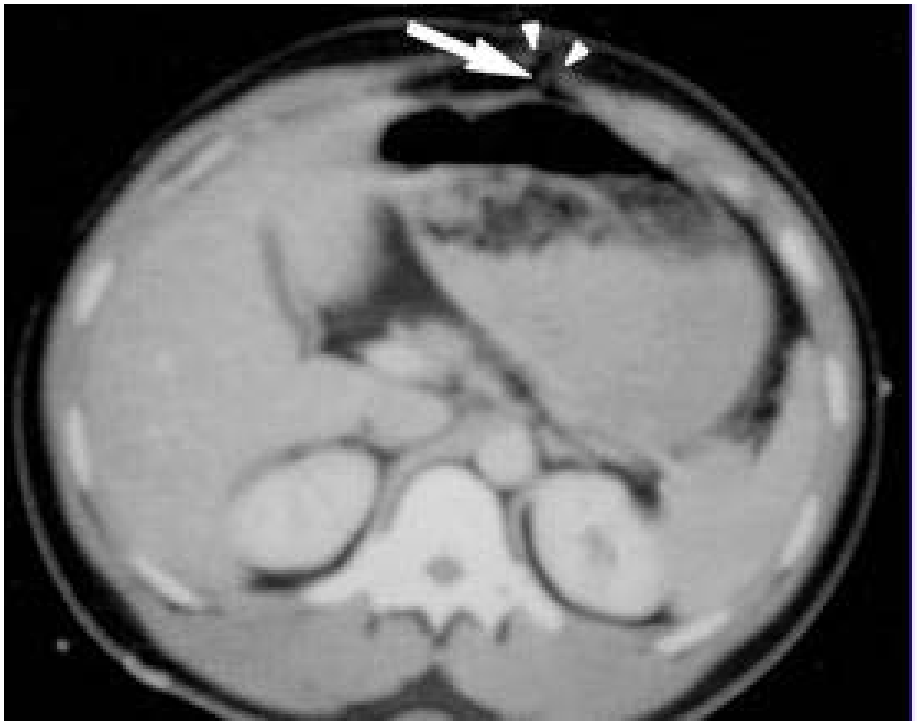
Totally 10 cases of stomach injuries were encountered in our study.

Immediate signs of laparotomy	4
Injury identified by CT	6
Laparotomy findings:	
Isolated injury	6
Associated injuries	4
Colonic laceration	2
Omental tear	1
Multiple injuries –duodenum 1st part, pancreatic and kidney laceration with retro peritoneal haematoma	1
Fundus of stomach	1
Body of stomach	7
Pylorus of stomach	1
Through and through injury of both Anterior and posterior wall of stomach	1
Mortality (multiple injury)	1

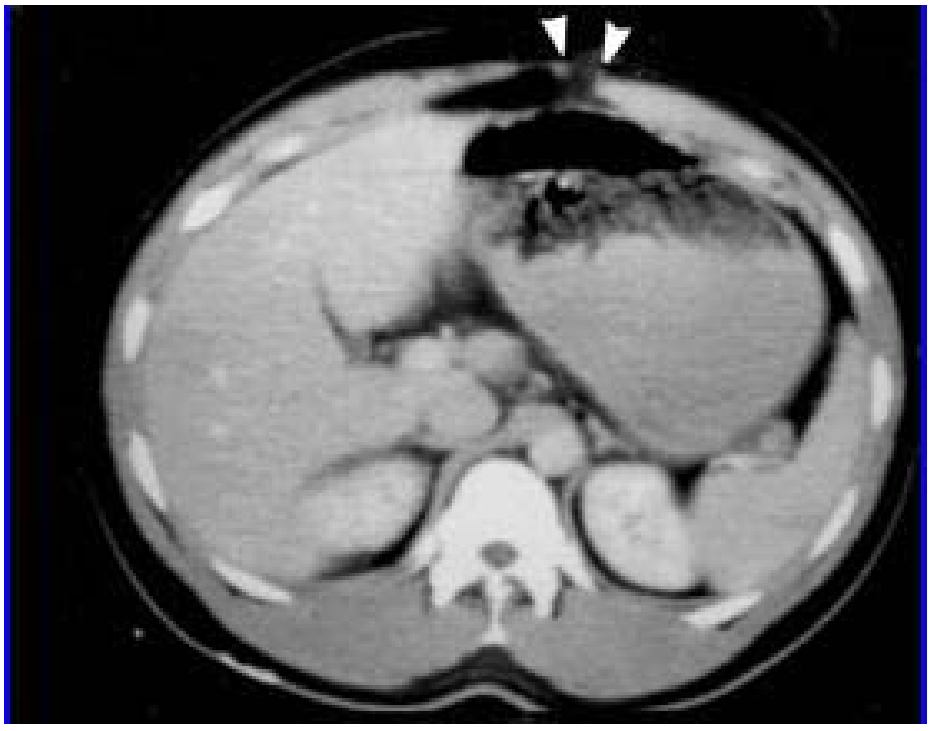
In all the cases, injury to posterior wall is searched for and other organ injury was ruled out and stomach wall was sutured primarily in two layers. Associated injuries were treated by primary suturing.

In all the cases, peritoneal lavage was given and drainage tube was kept.

PERITONEAL BREACH WITH WOUND TRACKING TO STOMACH



STAB INJURY SHOWING DEFECT IN ANTERIOR ABDOMINAL WALL



Other patient had multiple organ involvement. Laceration in the Stomach extends to 1st part of duodenum along the greater curvature, pancreatic and kidney laceration and retro peritoneal hematoma was present.

Patient presented with unstable hemodynamic status, resuscitated, and prepared for laparotomy. Stomach and duodenal injury was primarily sutured, diffuse bleeding from pancreas noted. Pancreas was sutured with non absorbable suture material, retro peritoneal hematoma left undisturbed. Patient continuously monitored but vitals were unstable and after 24 hrs re-laparotomy done. There was no bleeding and abdomen closed.
Patient died on 2nd post operative day due to shock.

DUODENUM

In this patient, duodenal injury was associated with pancreatic, hepatic and gastric laceration.

SMALL BOWEL INJURIES

Total no of cases	**16**
Emergency laparotomy **Indication-- peritonitis**	**3**
Identified by CT scan	**13**
Isolated	**9**
Associated with other injuries	**7**
Involvement of duodenum	**1**
Involvement of jejunum	**11**
Involvement of ileum	**5**

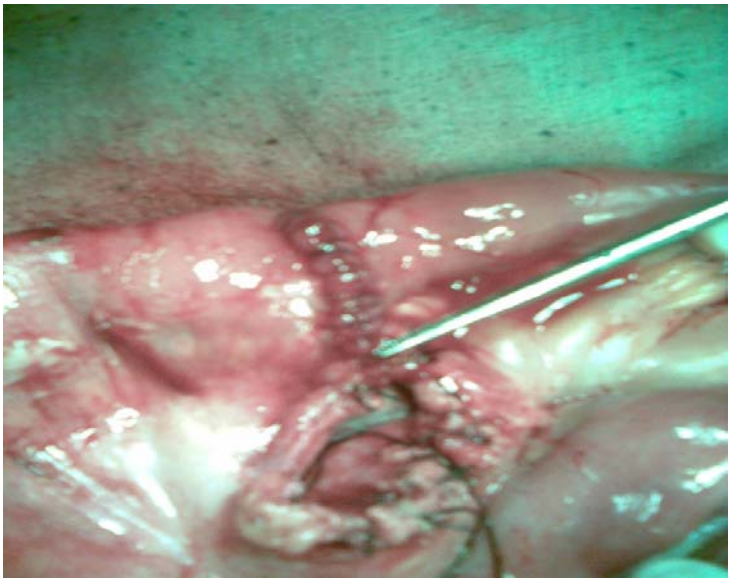
All bowel injuries involved the antimesenteric border and were less than 1 cm in diameter.

Associated injuries includes of colon, stomach or mesentery or omentum. All were sutured primarily except for the one where resection and anastomosis was done.

Rantley et al (23) emphasized the importance of careful examination of whole of the abdomen during laparotomy so as to avoid missing multiple injuries.

SMALL BOWEL INJURY

SMALL BOWEL RESECTION AND ANASTAMOSIS



COLONIC INJURIES

Total no of patients	8
Isolated	4
Associated injuries	4
Sigmoid colon	4
Transverse colon	4

In 2 patients injury was not identified by CT and was taken up for surgery in late stages as the patient developed peritonitis. Both of them had sigmoid laceration. One patient had faecal peritonitis and due to faecal contamination, rent in sigmoid colon was primarily closed and transverse loop colostomy was done. After 6 weeks colostomy closure was done.

For all patients, thorough peritoneal lavage was given and drainage tube was kept.

POST OPERATIVE COMPLICATIONS ENCOUNTERED IN HOLLOW VISCUS INJURY

28 patients underwent laparotomy for hollow viscus injuries. Out of which, 29% of patients developed complications.

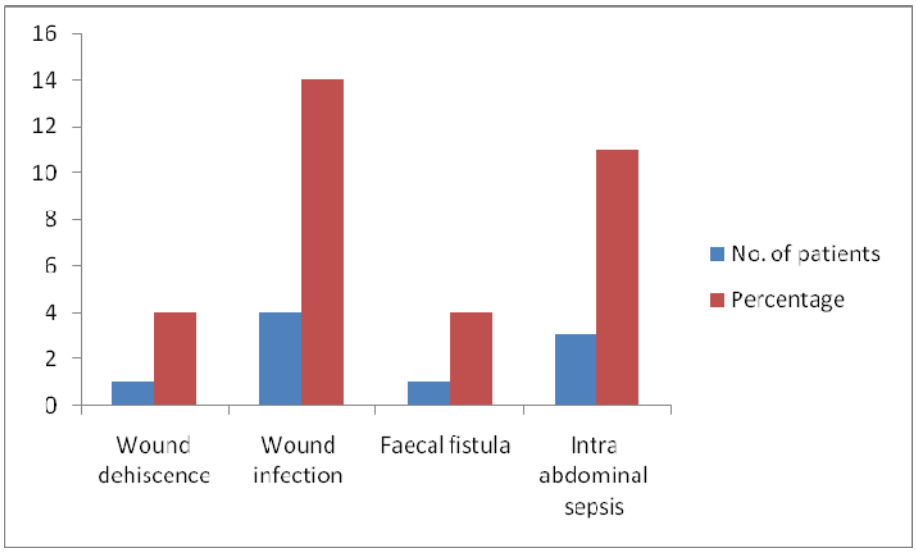
Complications	No. of patients	Percentage
Wound dehiscence	**1**	**4**
Wound infection	**4**	**14**
Faecal fistula	**1**	**4**
Intra abdominal sepsis	**3**	**11**

Common post operative complications following treatment of penetrating injury of abdomen is wound infection. One case of faecal fistula has been reported. It was reported in a case with missed findings in CT scan delayed identification of injury with the development of faecal peritonitis. The patient was managed conservatively and discharged without any complication. Colostomy was done in two patients who had faecal peritonitis because of delayed surgery as the injuries were not made out in CT scan. Colostomy closure was done after 2 months and both the patients improved normally.

MORTALITY

There was only one death reported in this study. The mortality rate is 1.8%.

POST OPERATIVE COMPLICATIONS



REVIEW OF LITERATURE

REVIEW OF LITERATURE

Historical aspect

First evidence of penetrating wounds were identified in Egypt where a mass grave yielded bodies of 60 soldiers with gaping wounds and arrows stuck in the body.(2000 BC).

Oldest medical textbook is Kahun Papyrus is a book on how to treat penetrating wounds. It dates back to 1900 BC provides sparse information dealing with surgery.

The need for trauma care and trauma center was recognised by Greeks. Galen (130 -200 AD) was an appointed surgeon in charge of gladiatorial game.

Ambrose Pare (Circa 1510 -1590) served during French – Spanish civil and religious wars. His contribution in treating penetrating trauma including gunshot wounds and use of nutrition in post – injury period was remarkable.

First description of small bowel penetrating injury was by Hippocrates.

In 1843 Gross described principles of intestinal sutures for penetrating bowel injuries. Patient with gastrocutaneous fistula following penetrating gastric injury was reported by Shenk in 11th century.

In penetrating abdominal injuries whether civilian or military, gun shot or stab, the most commonly injured organ is small bowel accounting for 49% to 60% of all injuries.

Earliest the best documented report of surgical treatment of a penetrating injury to duodenum was described by Summers in 1904. The incidence of duodenal injury was 3 – 5% in different centers.

In 1960, Shaftan (2) suggested the selective management of patients with stab wounds in the abdomen in order to avoid negative laparotomy.

ANATOMY

The abdominal cavity extends from fourth intercostal space to the groin crease anteriorly and from tip of scapula to buttock crease posteriorly. It has been further divided into following regions;

1) **Anterior abdomen**: anterior costal margins to groin creases between anterior axillary lines.
2) **Intrathoracic abdomen:** fourth intercostal space anteriorly (nipple line) and seventh intercostal space posteriorly (inferior scapular tip) to inferior costal margins.
3) **Flank:** inferior scapular tip to iliac crest between anterior and posterior axillary lines.
4) **Back:** inferior scapular tip to iliac crest between posterior axillary lines.

Trunkey (4) has suggested that anatomy of abdomen be considered in the context of the torso—a cylinder with an outer muscular coat that protects the viscera within.

The torso is divided into three coronal zones and three sagittal zones. Zone 1 is upper thorax. Coronal zones 2 and 3 represent abdominal contents. Zone

2 is the area between nipple and umbilicus. Zone 3 is the area below the umbilicus. Torso is further divided into three sagittal zones two lateral and one midline. Because heart, great vessels and spinal cord occupy the midline zone, penetrating injury to that zone is serious and lethal.

MECHANISM OF INJURY

Penetrating injuries are produced by crushing and separation of tissues along the path of penetrating objects. The clinical consequence of penetrating injuries depends on both the energy transfer and local tissue damage.

Several factors affect the degree of energy transferred to the tissues surrounding the tract of weapon. They are

1) Kinetic energy of the weapon or missile
2) The mean penetrating area
3) Weapon or missiles tendency to deform or fragment.
4) Density of tissues
5) Mechanical characteristics of the tissues.

Stab wounds

Majority of stab wounds are caused by knives. Some of these injuries are the result of sharp instruments or objects. In general stab wounds are less damaging than gun shot wounds and result in fewer complications.

Nearly one third of abdominal stab wounds do not penetrate peritoneal cavity and only 50% of those that penetrate require surgical intervention. (5).

Moore (6) and associates, and Croce (7) and co-workers have shown that number of organs injured, the penetrating abdominal trauma index and the abdominal septic complications are significantly lower in stab injuries than with gun shot wounds.

Gun shot wounds

Weapons that produce firearm injuries include rifles with kinetic energies up to 8000 ft-lb, shot guns and hand guns, which account for three fourth of all gun related homicides. When compared to stab wounds, gun shot wounds are associated with a higher penetrating abdominal trauma index score and subsequently higher complication rate. Lesions caused by high velocity missiles not only cause damage by direct contact, but also by blast effect. Unlike stab wounds 85% of abdominal gun shot wounds penetrate the peritoneal cavity and 95% of those cause significant intra abdominal injuries requiring surgical intervention. High velocity missiles cann be powerful enough to necrose bowel wall several inches from its original path.

Bull gore injuries

These are particularly common in rural setup. Such injuries are often associated with a blunt component.

IATROGENIC INJURIES

They are due to commonly performed diagnostic and therapeutic procedures. E g. peritoneal dialysis, laparoscopy, etc,

MANAGEMENT

PRE HOSPITAL CARE

General features of stabilisation and evaluation includes securing adequate airway, breathing, and inserting IV lines and beginning of fluid resuscitation.

In penetrating wounds

a) Sterile dressing should be applied.

b) Any foreign body embedded in the wound should not be removed as it may result in major bleeding.

c) Evisceration should be covered with sterile dressing and not to be disturbed.

HOSPITAL CARE

Initial assessment

1) Resuscitation – prime priority

As with any surgical disease or emergency, obtaining a careful history and performing a general physical examination are of importance in the care of trauma victim. But history taking should never delay in providing appropriate treatment for the patient.

The important aspects of history are

a) Time of injury

b) Type and size of wounding agent

c) Initial vital signs

d) Amount of blood at scene.

e) Position of patient with relation to assailant.

SURVEY OF INJURED PATIENT

Assessment of abdomen in multiple injured patients should take within the priority scheme of the primary and secondary surveys of the patient.

In the primary survey abdomen should be considered as the site of blood loss in a hypotensive patient after attention to airway, breathing, circulation and external bleeding.

In Multiple injured patient

Primary survey

1) immobilize cervical spine
2) secure airway
3) optimise ventilation
4) control external haemorrhage
5) establish IV access
6) Blood tests – haematocrit, amylase, grouping, typing and cross matching.
7) Radiological studies – cervical spine, supine chest, and pelvis.
8) ECG.

RESUSCITATION

Started with

1) A- airway
2) B- breathing
3) C- circulation
4) Upper extremity wide bore IV cannula should be started.

5) Blood sample for cross matching should be taken.

6) Coagulation profile, base deficit and hematocrit are helpful in monitoring the patients response to resuscitation and to some extent predict the prognosis. (3)

7) Rapid examination of whole body with arrest of bleeding sites should be done.

8) Physical examination of abdomen.

9) Close monitoring of patient to find out refractory shock due to intra peritoneal haemorrhage or other cause.

10) Stable patients may be planned for other investigations.

11) Nasogastric tube inserted and contents examined.

12) Bladder catheterised and urine examined.

13) Prophylactic antibiotics and tetanus prophylaxis given.

Physical Examination

The physical examination of abdomen must include its entire anatomic extent. It is possible to predict the underlying injured organ from the trajectory of wounding agent to some extent.

Inspection will reveal entry and exit wounds, lacerations, abrasion, abdominal distension, evisceration, impacted objects and some times bullet lodged in subcutaneous tissue.

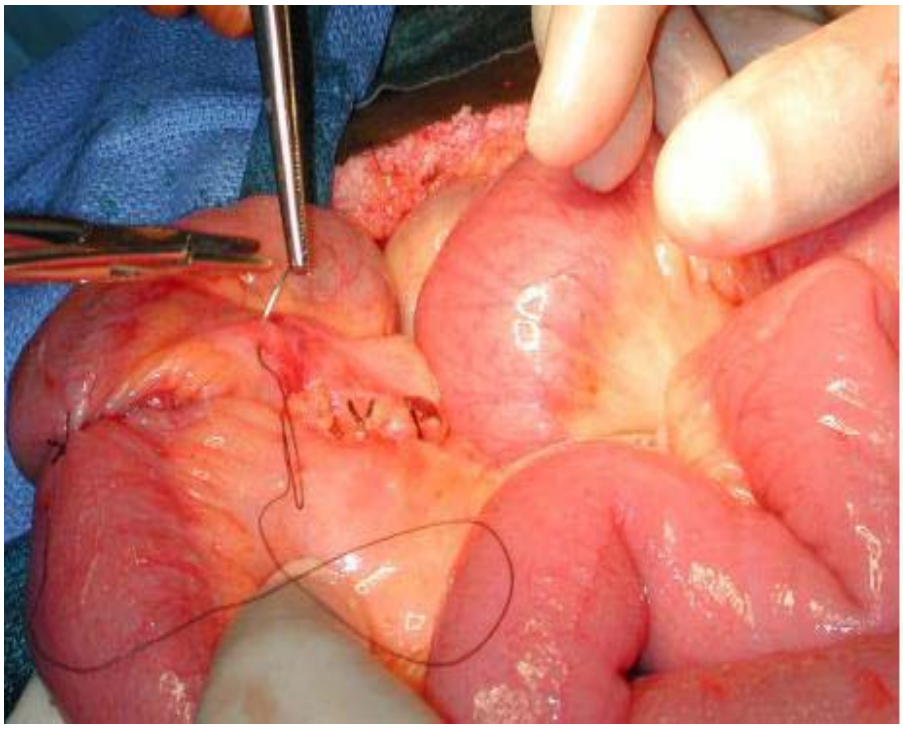
Palpation should focus on eliciting signs of peritonitis, tenderness away from the site of wound, involuntary guarding, rebound tenderness and rigidity. Localised tenderness may be caused by wounding agent without any underlying organ injury. The more diffuse the tenderness the more significant it is. Asking the patient to cough might elicit tenderness in patient with peritoneal irritation.

Auscultation of bowel sounds is important as absence of it may be suggestive of peritonitis. Occasionally extra abdominal injuries may also be the cause of absent bowel sounds. Normal or hyperactive bowel sounds are of less clinical significance. Rectal examination is important because one can detect blood which provides evidence for colorectal injury.

Because of its proximity, the chest should be evaluated with abdominal examination. Bowel sounds audible in the chest are suggestive of diaphragmatic injury and herniation. Abdominal examination should be completed by inserting a nasogastric tube and a Foley catheter to check for bleeding.

Abdominal examination is unreliable in cases of drug and alcohol intoxication, associated CNS trauma which interferes with initial examination. About 30% of patients with significant abdominal injury

MESENTERIC TEAR



EVISCERATION OF OMENTUM

initially lack physical findings (10) and 28 % of patients without peritoneal violation have positive examination (12).

There is a need for repeated abdominal examination particularly in stable patient who is admitted for observation and might develop peritoneal signs at a later stage (13).

Mandatory exploratory laparotomy for abdominal stab wounds results in 14% - 50% of non therapeutic laparotomy.(14,15,16) Non therapeutic laparotomy is defined as an exploratory surgery of the abdominal cavity that reveals no or minimal organ injuries, not requiring placement of sutures or electrocoagulation, or topical haemostatic agents to stop active bleeding. Evacuation of non contaminated blood and hemostasis of bleeding from the stab wound site is also accepted as non therapeutic laparotomy.(17).

As negative laparotomy increases the morbidity appropriate investigations are done before selective exploratory laparotomy.

Those with hemodynamic instability, peritoneal signs, evisceration, gastrointestinal bleeding and gun shot wounds with obvious peritoneal penetration should undergo emergency laparotomy.

If none of these indications are present, a more detailed approach is indicated and further investigations are performed.

Stable patients with stab wounds to anterior abdomen can be managed in different ways.

Preliminary Local wound exploration followed by CT scan to rule out peritoneal penetration and those patients who do not have peritoneal violation can be discharged home safely. CT scan that demonstrates visceral injuries can be managed accordingly.

The second approach is based on serial physical examination for a period of 24 to 48 hours by the same surgeon at triage ward, if CT scan is not available or if initial CT scan does not show any findings. The development of peritoneal signs should be an indication for immediate exploration. The disadvantage of this guarded approach is the delay in the therapeutic surgery which leads to complications some times life threatening.

Laparoscopy is particularly useful in stab wounds to lower chest or upper abdomen as none of the other investigation are reliable. Those with evidence of peritoneal penetration and bleeding solid organ laceration can be managed safely.

In those with stab wounds to back or flank are managed by triple contrast CT SCAN as it can evaluate and identify the injury. (25).

Investigations

The classic signs of peritonitis including diffuse tenderness, guarding, and rebound tenderness or hemodynamic instability or evisceration make exploratory laparotomy mandatory regardless of cause of injury.

But many patients may not have all these findings and relying on physical examination alone can be misleading.

Investigations include:

- Radiological studies
    1) Chest X ray PA view
    2) Abdominal X ray (supine, erect, lateral decubitus film)
    3) Ultrasonogram
    4) CT scan with contrast

Plain X- ray films, local wound exploration, ultrasound, CT have become useful adjuncts in the management of trauma patients with suspected abdominal injuries.

Plain films

Chest X-ray

As lower chest wounds may involve abdominal organs or upper abdominal injuries may be associated with thoracic injuries, a chest radiograph should be obtained in upright posture and is used to look for free air under the diaphragm, associated thoracic injuries unsuspected thoracic disease or diaphragmatic injuries with herniation.

Abdominal X ray

Abdominal films are useful for gun shot wounds and for impalement injuries because the films can document the presence and location of foreign bodies. If foreign body is seen on an anteroposterior film a lateral X- ray is useful for better localisation. It may be useful to determine the location of missile because it helps to delineate the areas that require deliberate exploration.

The presence of free air suggest perforation of gastrointestinal tract particularly stomach or colon. Other radiographic signs such as deviation of stomach gas bubble to right or presence of large mass effect in left upper quadrant are suggestive of splenic injury.

The value of X- ray of abdomen in case of stab wound is questionable because the free air under the diaphragm may have entered

through stab wound and may not be bowel air. Therefore abdominal films contribute less in investigating penetrating abdominal injuries.

X ray chest and abdomen

1) Air under diaphragm- hollow viscus perforation.
2) Loss of psoas shadow
3) Absence of gas in duodenal bulb
4) Lower rib fractures
5) Pneumothorax
6) Haemothorax
7) Abdominal contents in chest

ULTRASONOGRAM (10&11)

This is a non invasive diagnostic tool with very high accuracy rate in diagnosing hemoperitoneum. However it has serious limitations in diagnosing diaphragmatic, pancreatic and intestinal injuries.

FOCUSSED ABDOMINAL SONAR FOR TRAUMA (FAST)

1. mainly examining
    - precardial area
    - right upper quadrant
    - left upper quadrant
    - Pouch of Douglas.

In unstable patients if FAST is positive, neglect other investigations and proceed with Exploratory Laparotomy.

In haemodynamically stable patient, a positive FAST does not per se, indicate the need for surgical exploration. Follow up with other investigations.

LIMITING FACTORS OF ULTRASOUND

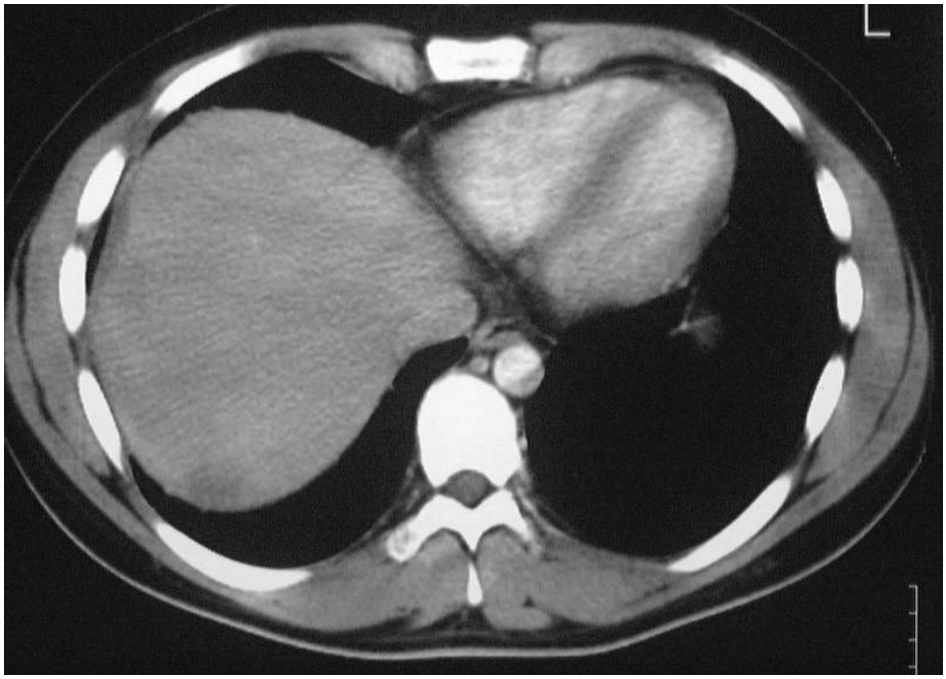
1. Poor for hollow viscus perforation.
2. Operator dependant.
3. Compromised by lower rib fractures, soft tissue injuries, and dressings.
4. Obesity, gas interposition, subcutaneous emphysema and injuries that do not cause changes in tissue interface.

Ultrasound	Stab injury
Sensitivity	46%
Specificity	94%

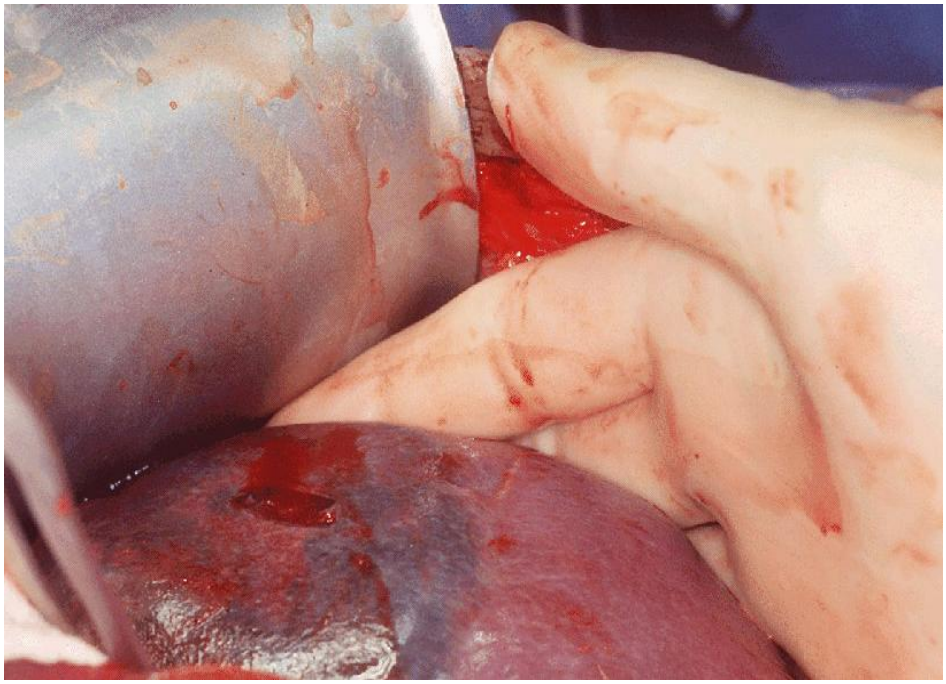
CT ABDOMEN

Computerized tomography (CT scan) of the abdomen was sensitive to intraperitoneal findings suggestive of or diagnostic for gastrointestinal injury. Speedy operative management is of the utmost importance. The

STAB INJURY SHOWING GRADE I HEPATIC INJURY



SPLENIC HEMATOMA



majority of intestinal damage can be repaired by simple closure or resection.

CT scan is highly accurate in excluding peritoneal violation and can be used for selecting patients for non-operative management without significant missed injuries.(8).

CT findings of peritoneal violation

1) Presence of wound tract lined by air,
2) Intra peritoneal free air or free fluid.(9).

Routine administration of oral and rectal contrast material is used to increase the sensitivity of CT to detect bowel injuries. Following are the signs of bowel injury:

- Small amounts of intermesenteric fluid,
- Mesenteric contusions, or
- Infiltration of mesenteric fat
- Extravasation of oral or colonic contrast
- Bowel wall thickening
- Mesenteric bleeding
- Mesenteric infiltration or stranding
- Bowel wall defect or discontinuity
- Focal mesenteric hematoma

- Wound tract extending up to the wall of a hollow viscus. Following are the signs of solid visceral injury:
- Intra parenchymal hematomas seen along the wound tract in to the solid organs
- Sub capsular hematomas
- Lacerations along the wound tract in to the solid organs

Ct scan is considered positive if there is evidence of

1) Peritoneal violation,
2) Intra peritoneal visceral injuries
3) Injury to renal collecting system
4) Injury to retroperitoneal colon or duodenum or major vascular structures.

DIAGNOSTIC LAPAROSCOPY (18)

- can be used for both diagnostic and therapeutic purpose
- Useful in thoraco-abdominal injuries
- Appropriate in penetrating injuries to know about peritoneal breach and diaphragmatic injuries.
- Avoids unnecessary exploration.
- Should not be performed in unstable patients, patients with poor cardio respiratory reserve, previous surgical scars.

The surgeon has to give three vital decisions in the management of abdominal stab wounds.

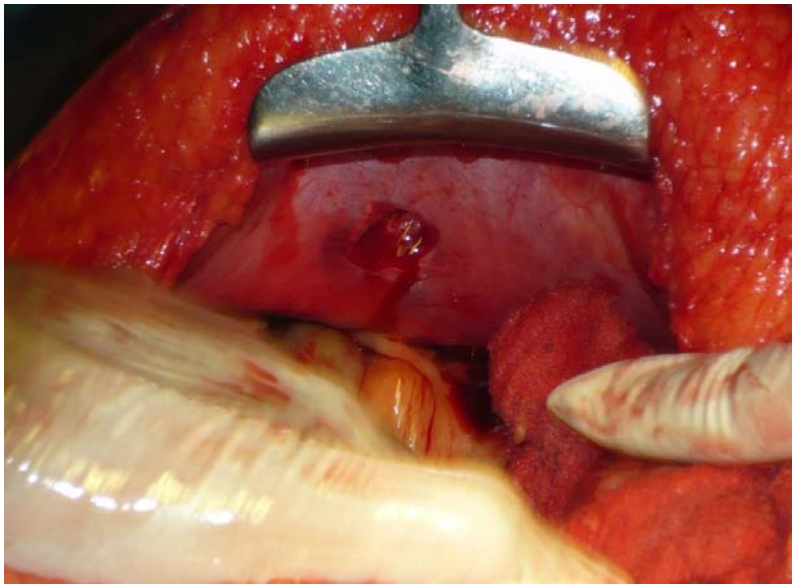
First is the violation of the peritoneum.

Second is the presence of an intraperitoneal injury.

Third is the requirement for laparotomy

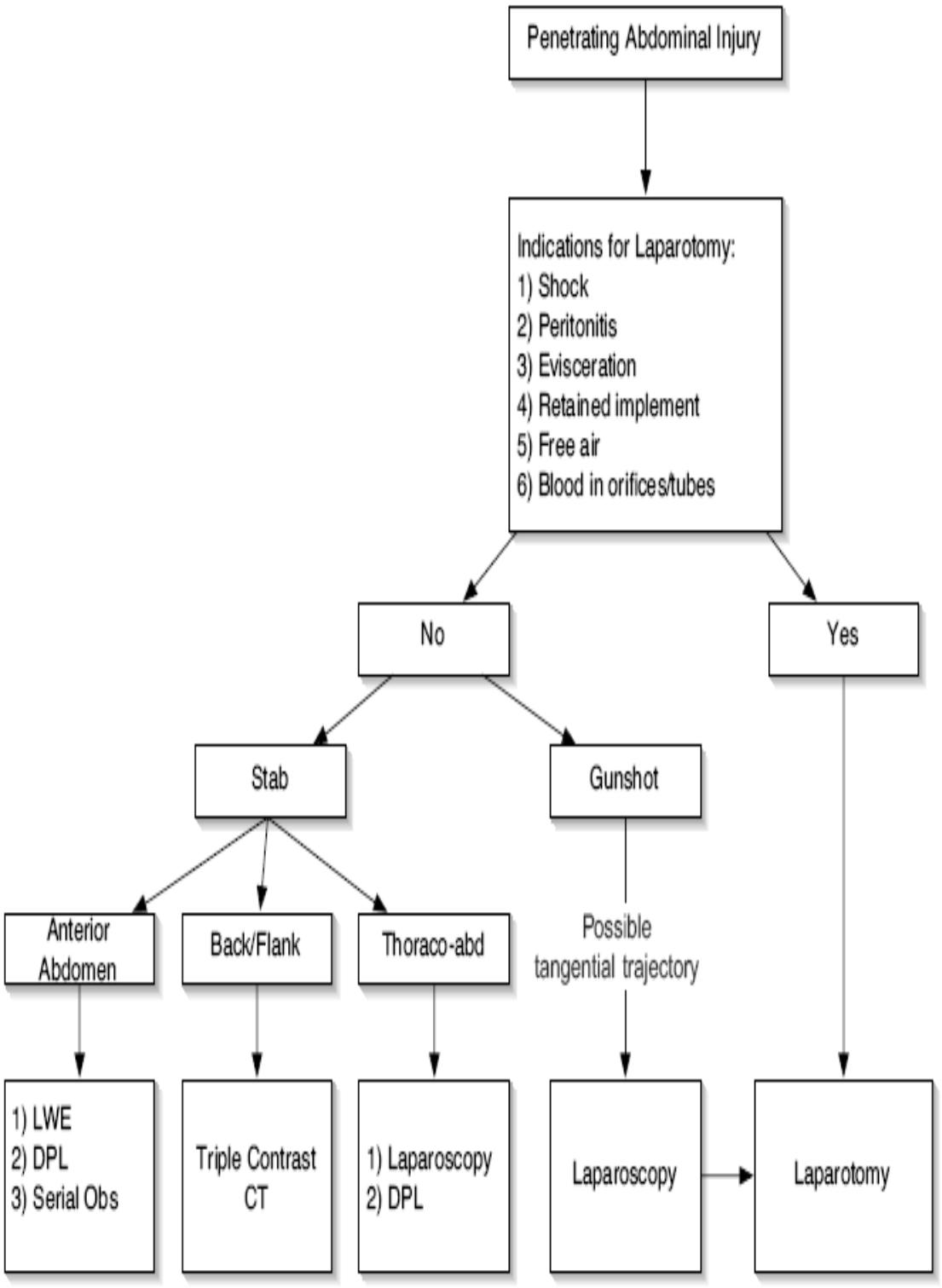
The surgeon has to make the appropriate choice among these techniques, in the right time.

INTRA ABDOMINAL ASPECT OF STAB WOUND SITE



EXTERNAL INJURY

MANAGEMENT OF PENETRATING TRAUMA



TREATMENT

Selective conservatism for stab wounds to anterior abdomen has been shown to be safe and effective. It was originally pioneered by Shaftan (1).

The best approach would be the one that minimises the number of missed injuries and the number of non- therapeutic laparotomies.

EXPLORATIVE LAPAROTOMY

- Pre requisites

1) High risk informed consent to be obtained
2) Consent for ostomy and staged procedures is to be obtained for visceral injuries.

INDICATIONS FOR LAPAROTOMY

1) Signs of peritoneal injury
2) Unexplained shock
3) Evisceration of viscus (6)
4) Positive diagnostic peritoneal lavage
5) Deterioration of findings during non-operative follow-up
6) Significant bleeding via nasogastric tube or from the wound
7) Gun shot wound

EXPLORATIVE LAPAROTOMY TECHNIQUE

PREREQUISITES

1) Adequate blood should be started as when the abdomen is opened the tamponade effect maintained by the wall is released resulting in profuse bleeding.
2) Avoid hypothermia
3) Antibiotic coverage

For all explorative laparotomies long vertical midline incision is preferred. As it can be extended upwards or downwards and can be converted into thoraco abdominal incision.

Oblique extension can be done through the rectus.

There should not be hesitation in making big incision which will be helpful in performing complete abdominal examination during surgery.

Once abdomen is opened, obvious blood and clot is removed by packing all four quadrants of the abdomen.

Control of bleeding is the main aim of surgery.

It is followed by methodical examination of the abdomen. Always follow same sequence.(19).

1) Right lobe of liver, gall bladder, left lobe of liver, spleen.

2) Diaphragmatic hiatus, abdominal oesophagus, stomach

3) Bile ducts, right kidney, duodenal loop, head of pancreas, now draw
The transverse colon out of the wound towards the patient's head, body
And tail of pancreas, left kidney.

5) Root of mesentery, superior mesenteric artery and vein, small bowel
From ligament of Treitz to ileocaecal valve.

6) Appendix, caecum, the rest of the colon, rectum.

7) Pelvic peritoneum, uterus, tubes and ovaries in the female,
Bladder, hernial orifices and main iliac vessels on each side.

Examine all viscera, explore the lesser sac, and identify all sources of bleeding.

Thoraco- abdominal trauma

- Penetrating thoraco- abdominal trauma with the abdominal physical findings or haemodynamic instability → laparotomy.
- Thoraco- abdominal wound with haemothorax or pneumothorax → insert ICT drainage → if diaphragmatic injury is present → laparotomy.
- Thoraco- abdominal wound without haemothorax or pneumothorax → laproscope → if diaphragmatic injury is present → laparoscopic repair or laparotomy done.

NEW CONCEPTS IN PENETRATING ABDOMINAL TRAUMA

1) Damage control approach in exsanguinating penetrating abdominal injury (26)
2) Abdominal hypertension

DAMAGE CONTROL APPROACH

It is defined as initial control of haemorrhage and contamination followed by intraperitoneal packing and rapid closure.

It is followed by rapid resuscitation to normal physiology in the intensive care unit.

And subsequent definitive re-exploration is adopted.

Initial operation

Minimal procedure is done to save the patient's life.

Eg. Packing, ligation of vessels, instead of repair, placement of foley's catheter.

ORGAN INJURY SCALE (OIS)

The Organ Injury Scaling was developed by the Organ Injury Scaling Committee originally convened in 1987, these scoring systems are modified and updated as deemed appropriate.

The scale is graded 1 through 6 for each organ, 1 being least severe and 5 the most severe injury from which the patient may survive. Grade 6 injuries are by definition not salvageable.

It is a type of anatomic injury scale. Concept does not include the significant physiologic variable that may profoundly influence outcome. (age, pre-existing disease, acute blood loss, time from injury to definite care, associated injury.)

TRISS trauma and injury severity scale

It determines the probability of survival of patients from injury severity score and revised trauma score. TRISS (24) is complex as it involves 8-10 variables.

MTOS major trauma outcome studies

MTOS major trauma outcome study is simpler and alternative models. It was primarily used in quality assurance in trauma care centers.

INDIVIDUAL HOLLOW VISCUS ORGAN INJURY MANAGEMENT

STOMACH

It is one of the common organs involved in penetrating trauma. Nasogastric tube should be inserted and examined for blood in the contents.

Grading of stomach injuries:

Grade	Lesion
1	Superficial haematoma Partial thickness laceration
2	Laceration < 1 cm
3	Laceration 1-5 cms
4	Laceration 5-10 cms

OPERATIVE MANAGEMENT

Midline laparotomy is preferred. The extent is tailored to the site of wound. Priorities are the following

1. Haemorrhage control

2. Contamination control by applying Babcock's forceps to hollow viscus wounds.

3. Identification of injuries esophagogastric junction, fundus, lesser curvature and posterior wall of the stomach is to be examined.

If necessary, short gastric vessels are ligated and cut when an injury to splenic area is suspected. Stomach is pulled with pads to visualize the anterior wall.

Posterior wall can be inspected by opening the avascular portion of omentum near the transverse colon. Because the posterior wall of stomach is adherent, it is preferable to open more on the left.

4. Gastric repair

Primary closure using two layer technique.

In the esophagogastric and pyloric area suturing results in postoperative stenosis -- avoided by a transverse closure.

Pyloric wounds may be converted to a pyloroplasty.

Gastric resection (rarely).

Complications

1. Bleeding.
2. Gastric Fistula.
3. Abscess in the lesser sac.
4. Emphysema.

Morbidity – 27% Mortality -14%

DUODENUM

The duodenum is an organ poorly designed to withstand traumatic injuries. Its retroperitoneal location accounts for high incidence of misdiagnosed injuries that carry very serious consequences.

It shares marginal blood supply with pancreas. Also duodenum is in close proximity to vital structures like aorta, inferior venacava superior mesenteric vessels, colon and kidney.

Incidence is 3 to 5%.

Suspect Duodenal Injury in the following cases:

1. History of rapid deceleration.
2. Blood in Nasogastric Aspiration.
3. Blood or Bile staining of the midline retro-peritoneum during laparotomy.
4. Stab wounds in the upper abdomen.

DUODENUM INJURY SCALE

	Grade*	**Injury Description**
I	Haematoma	Involving single portion of duodenum
	Laceration	Partial thickness, no perforation
II	Haematoma	Involving more than one portion
	Laceration	Disruption < 50% of circumference
III	Laceration	Disruption 50%-75% circumference of D2
		Disruption 50%-100% circumference of D1,D3, D4
IV	Laceration	Disruption > 75% circumference of D1, D3, D4
V	Laceration	Massive disruption of duodenopancreatic complex
	Vascular	Devasculasrization of duodenum.

Upper GI study with soluble and non-soluble contrast as well as CT scan with intraluminal and intravascular contrast plays a small role in diagnosis of penetrating duodenal injuries.

Management

- Abdominal exploration should be done through a classic midline incision.
- Achieve immediate control of haemorrhage.
- Control all GIT spillage.
- Bile staining of periduodenal tissue should raise the suspicion of duodenal injury.
- Total mobilisation of duodenum is done by Kocher maneuver, Cattell and Braasch (38) maneuver.
- Any finding such as haematoma, edema, or requires a thorough exploration of duodenum.

Treatment of Duodenal Injury

Various techniques and procedures used for repair of duodenal and pancreaticoduodenal injuries are:

1. Duodenorrhaphy
2. Duodenorrhaphy with external drainage
3. Duodenorrhaphy with tube duodenostomy

A. Primary (through duodenum)

B.antegrade (through pylorus)

C. Retrograde (through jejunum)

4. Triple ostomy technique (gastrostomy and antegrade and retrograde jejunostomies)

5. Jejunal serosal patch

6. Jejunal mucosal patch

7. Pedicle grafts

A. Ileum

B. Jejunum

C. Stomach

8. Duodenal resection

A. Duodeno duodenostomy

B. Duodeno jejunostomy

9. Duodenal diverticularization (39)

- In Major duodenal injury or combined pancreaticoduodenal injuries
- Designed to exclude repaired duodenum from passage of gastric contents

- Includes gastric antrectomy, closure of first part of duodenum, gastro jejunostomy, vagotomy and tube duodenostomy.

10. Pyloric exclusion

    A. with sutures

    B. with staples

11. Pancreatico-duodenectomy (Whipple's procedure)

All duodenal repairs should be accompanied by a closed suction drainage. This serves as an early detection system during the development of a duodenal fistula.

Mortality and Morbidity Rates

Mortality is 5.3% to 30%.

Morbidity is 38% to 75%.

Other complications of duodenal injuries are

- Duodenal obstruction,
- Intraabdominal abscess,
- Recurrent pancreatitis and
- Biliary tract fistula.

THROUGH AND THROUGH BOWEL INJURY

INTRA PERITONEAL HAEMATOMA

SMALL INTESTINE

In penetrating abdominal injuries the organ most frequently is small bowel. It accounts for 49% to 60% of all injuries.

	Grade*	**Injury Description**
I	Haematoma	Contution or Haemotoma without devascularisation.
	Laceration	Partial thickness, no perforation
II	Laceration	Laceration <50 % of circumference.
III	Laceration	Laceration ≥ 50% of circumference without transection
IV	Laceration	Transection of small bowel
V	Laceration	Transection of small bowel with segmental tissue loss.
	Vascular	Devasculasrized segment.

* Advanced one grade for multiple injuries upto Grade III.

OPERATIVE MANAGEMENT

Midline laparotomy is preferred. The extent is tailored to the site of wound.

Identification of injuries

Start with supramesocolic compartment structures: Liver, spleen, left kidney, stomach, first and second portion of duodenum, pancreas and diaphragm.

Infra mesocolic examination is carried out by eviscerating the colon cephalad and jejunum-ileum to the right. This allows examination from fourth portion of duodenum to the rectum.

Bowel repair

Following things should be ensured during bowel repair.

1. Good blood supply
2. No tension
3. Adequate lumen
4. Water tight anastomosis
5. No distal obstruction

Currently many techniques are used for small bowel anastomosis. This includes stapling devices, single or double layer, interrupted or continuous and absorbable or non-absorbable materials. Single layer anastomosis caused less narrowing of lumen. Devascularisation, infection and necrosis are more likely to occur after double layer than single layer. Continuous techniques have the advantage of being performed more rapidly and reduce the risk on untying because of less number of knots.

If viability is not certain, resection is preferred.

Small bowel injuries are closed in transverse fashion to avoid postoperative stenosis.

Multiple wounds in close proximity of devascularised segment are best managed by segmental resection and end-to-end anastomosis.

Before closing abdominal cavity it is irrigated with warm saline solution until the effluent is clear.

Complications

Most frequent complications after small bowel penetrating trauma are:

1. Abdominal sepsis
2. Short bowel syndrome
3. Intestinal fistula
4. Hemorrhage

Mortality ranges from 11% to 17% and is influenced by associated trauma.

COLON

Penetrating injuries to colon are becoming more frequent with increased civilian violence.

Risk factors in colon injury management

1. Shock

It has been observed that mortality rate was significantly increased in the presence of sustained hypotension pre- and intraoperatively.

2. Duration from injury to operative control

Delayed treatment of colon injuries is a significant predictor of postoperative morbidity. This is because of continued blood loss and faecal contamination of peritoneal cavity. Primary repair of colon injury in such situation is not recommended.

3. Faecal contamination This has been quantified as

Mild: Contamination in the vicinity of colon injury.

Moderate: More extensive but confined to a quadrant of abdomen.

Severe: Extensive contamination involving all quadrants

4. Associated injuries

The mortality and septic morbidity are higher in patients with greater number of associated organ injury but are not contraindication for a primary repair of colon injury.

5. Blood transfusion

The number of units of blood transfused is an independent risk factor for morbidity.

6. Anatomic location of injury

Colonic injury at any location should be managed similarly as far as primary repair is concerned.

Injury severity ASSE

COLON INJURY SCALE

	Grade*	**Injury Description**
I	Haematoma	Contusion or haemotoma with out devascularisation
	Laceration	Parial Thickness, no perforation
II	Laceration	Laceration <50 % of circumference
III	Laceration	Laceration ≥ 50 % of circumference without transaction
IV	Laceration	Transection of Colon
V	Laceration	ransection of Colon with segmental tissue loss.

- Advanced one grade for multiple upto grade III

Management of penetrating colon injuries

Therapeutic options can be classified as

1. Definitive methods (primary repair, resection and anastomosis, repair of lacerated colon and exteriorisation)

2. Colostomy (either loop or end colostomy).

Primary repair

There is an increasing tendency to use primary intraperitoneal closure for perforated colon. Primary repair can be used regardless of risk factors provided adequate debridement is done. Outcome is good for those with low injury severity scores.

Resection and anastomosis

When the injured colon segment is extensive resection and anastomosis is optimal treatment.

Exteriorization of the repair

Role of this repair in colon injuries is controversial.

The advantages of such repair are:

1. It brings suture line out of peritoneal cavity and obviates the intraperitoneal leak.
2. Colon wound repair can be observed for satisfactory healing.
3. If there is breakdown of repair it can be converted to a colostomy at bed side.
4. Second operation for interiorization of the repair is simpler then the one for closure of colostomy.
5. It is associated with lower morbidity from septic complications

COLOSTOMY

End colostomy

It is still safest treatment of colon injuries. Distal end of colon may be managed as a mucous fistula or may be sutured and left intraperitoneally as a Hartmann type of resection. End colostomy is particularly recommended

for patients with multiple injuries and when a segmental resection of colon is indicated.

Loop colostomy

Indication for loop colostomy in colon trauma is when injury to colon is confined to one circumference of the wall and the injury is being exteriorized as a colostomy. Occasionally injuries to sigmoid colon with short mesentery where colostomy of the injured site is not possible, injury is treated primarily and a proximal loop colostomy is constructed for faecal diversion.

Disadvantages of colostomy in colon injury management

Stomal complications like stomal obstruction, peristomal abscess increases the morbidity. It also requires subsequent surgery for closure.

Results of colon injury management

Mortality is due to sepsis and multi organ failure with or without anastomotic leak. This ranges from 1-7%.

Morbidity:

Complications are

- Intraabdominal abscess,
- Faecal fistula,
- Multi organ failure,
- Stomal related complications.

RECTUM

Types

1) Intra Peritoneal 2) Extra Peritoneal

Causes

I) Gun shot wounds

1) Penetrating injuries over gluteal region (impalement injuries)

2) Act of auto eroticism and sexual misadventure

3) Iatrogenic

Proctoscopy should be done in all cases.

In doubtful cases, X-ray examination with soluble contrast may be done

RECTUM INJURY SCALE

	Grade*	**Injury Description**
I	Haematoma	Contusion or haemotoma with out devascularization
	Laceration	Parial Thickness Laceration no perforation
II	Laceration	Laceration <50 % of circumference
III	Laceration	Laceration ≥ 50 % of circumference
IV	Laceration	Full thickness laceration with extension in to perineum
V	Vascular	Devascularized segment

*Advanced one grade for multiple up to grade III

Treatment

Principles of operative management

1) Placement of patient in lithotomy position
2) Wide debrdement of dead and devitalised tissue
3) Totally dysfunctioning colostomy
4) Rectal injury closure if possible
5) Antibiotic, nutritional support and repeat debridemnt

DISCUSSION

DISCUSSION

IDENTIFYING PERITONEAL VIOLATION BY CT SCAN

In this study of among the 45 patients who underwent CT, the peritoneal violation was defined with certainty in 35 patients (78%).

This correlates with Demetrios Demetriades et al (22) study conducted during 2004 - 2006 as a prospective study. The CT was done in 67 patients, of which 47 patients had evidences of peritoneal violation (70%).

The most common CT finding of peritoneal violation was free intraperitoneal fluid seen in 85% (30/35) of patients. Other findings were wound tract entering into the peritoneal cavity in 51% of patients (18/35), free air in 45% (16/35) of cases and intraperitoneal visceral injury in 82% (29/35) of cases.

This correlates well with Chiu W.C et al (9) study which shows 94% of intraperitoneal free fluid, 54%of patients showing wound tract entering to the peritoneum, 43% of pneumoperitoneum, intraperitoneal visceral injury in 60% of patients.

Of the 26 patients who underwent laparotomy

CT finding **Peritoneal breach**	**Laparotomy** **Confirms breach**	**Conservative** **management**	**Total**
Present	**26**	**9**	**35**
Absent	**0**	**10**	**10**
Total	**26**	**19**	**45**

Of these 35 patients who showed positive peritoneal penetration in CT, only 26 patients underwent laparotomy and peritoneal violation was confirmed surgically in all of them. CT was negative for peritoneal violation in 10 patients. All of them were treated conservatively, showing 100% sensitivity and 100% specificity, confirming its accuracy in identifying peritoneal breach.

Regarding 10 patients with no peritoneal violation were discharged uneventfully.

CT finding Intra abdominal injuries	Laparotomy	Conservative management	Total
Present	**22**	**2**	**24**
Absent	**2**	**9**	**11**
Total	**24**	**11**	

Of the 35 patients with peritoneal violation 29 patients were showing evidence of intraperitoneal visceral injuries and 6 patients with no visceral injuries.

The sensitivity is: 92%.

The specificity is 82%

Positive predictive value of CT scan: 92%.

Negative predictive value is 82%.

In Chiu W.C et al study CT has a sensitivity of 97%, specificity of 98% and accuracy of 98%.

MORBIDITY FOLLOWING PENETRATING INJURIES ABDOMEN

A hollow viscus injury carries additional importance because it is often associated with peritoneal contamination of gastric, pancreatic secretions, bile or faecal matter.

Post operative complications are the major cause of morbidity and contribute significantly to increased length of hospitalisation and costs of patient care.

Morbidity following penetrating injuries to abdomen depends on various factors including patients age, number of unit of blood transfused, the organ injured, severity of injuries sustained, multiple intra abdominal injuries and associated extra abdominal injuries, co morbid illnesses, type of treatment adopted, delayed intervention and peritoneal contamination, choice of antibiotics, duration of antibiotic administration and wound management.

In this study 8 (29%) patients developed complications following hollow viscus injuries. This correlates well with Salim A et al (37)study conducted on 57 patients with stab injuries. Post operative complications occurred in 20% of cases. This study also shows that there is increase in complication rate when there is associated duodenal or colon injuries.

Organ injured	No of patients with complication
Stomach	1
Jejunal injuries	3
Ileal injuries	1
Colonic injuries	2
Jejunum with colon	1

Though in this study wound infection is more common in jejunal injuries, the most dreaded complications like intra abdominal sepsis and faecal fistula is common with colon injuries.

Primary repair of colon or resection and anastomosis without colostomy may be considered only when all the following criteria are met: any patient who present without shock, no extensive faecal contamination, not having multiple injuries, no significant blood transfusion requiring blood transfusion of more than 6 units, no prolonged delay to operation, injury should not involve left side of colon (36).

Early diagnosis and surgical treatment is important in reducing the peritoneal contamination and thereby reduces the morbidity and mortality.

Most common complication encountered was wound infection which was treated by appropriated antibiotics.

Three cases of intra abdominal sepsis were reported, 2 of them had faecal contamination of peritoneum following sigmoid colon laceration. Another patient following jejunal tear. All of them were treated conservatively with appropriate antibiotics and blood transfusion.

Majority of patients were presented to hospital immediately after stab injuries, complications were relatively less.

The ultimate goal in managing penetrating abdominal trauma is not only the early identification of injuries and appropriate treatment, but also to avoid unnecessary laparotomies. To accomplish this, patients are to be correctly selected and subjected to CT scan of the abdomen, which accurately identifies the need for further laparotomy.

Considering the benefits of avoiding unnecessary hospital stay, man power loss, and also the accuracy of CT scan in identifying peritoneal breach and visceral injuries, such investigation is to be offered as a first line of investigation in stable patients.

As this is an emerging field, more and more patients have to be subjected to these imaging modalities so that we become familiar with the findings and get more rationalized in offering specific treatment to these patients.

As these modalities are not widely available in all health care centers, appropriate steps have to be made in wider availability of this investigation as an important protocol in managing penetrating abdominal injuries.

CONCLUSION

CONCLUSIONS

Following this retrospective study of 53 cases of penetrating abdominal trauma the following conclusions can be made:

1) Young males were predominantly involved between the age group of 20 to 40 yrs.
2) The commonest mode of penetrating injury is by stab wounds to abdomen.
3) Careful and repeated clinical examination and appropriate diagnostic investigations leads to successful treatment in these patients.
4) Those patients with haemodynamic instability, generalised peritonitis, evisceration of omentum and bowel, and hemorrhage are the potential candidates for early mandatory laparotomy.
5) Evidence of peritoneal penetration alone is a poor indicator for laparotomy which may add on to the negative laparotomies and thereby increasing the morbidity and mortality.
6) Computed tomography is highly sensitive in predicting both peritoneal penetration and intra abdominal visceral injuries.
7) Small bowel and stomach are common viscera injured in the present study.
8) Post operative wound infection is the common complication encountered. Intra abdominal sepsis and faecal fistula is encountered in

delayed laparotomies thereby indicating the importance of early identification of injuries and early institution of treatment.

SUMMARY

1) Maximum number (42%) of cases in the age group of 30 to 40 yrs
2) Males are commonly affected. 85% of cases.
3) Assault injuries account for – 87% of cases of penetrating abdominal injuries.
4) Peritoneal violation seen in 78% of cases as evidenced by CT scan.
5) 64% of cases underwent laparotomy.
6) Laparotomy was therapeutic in 94% of cases.
7) Only 2 patients required delayed laparotomy.
8) Serial abdominal examination and if necessary repeat CT is important in avoiding missed injuries.
9) Small bowel was commonly injured organ in this study
10) 29% developed post operative complications
11) Wound infection was the commonest complication.
12) Dreaded complication like faecal fistula developed following delayed laparotomy
13) Mortality rate is 1.8%.

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PROFORMA

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Name

Age and sex

IP/ OP number

Date of admission

Date of discharge

Presenting history

Mode of injury

Weapon used

Complaints

Pain abdomen

Vomiting

Bleeding from wound

Vomiting

Protrusion of viscera

Haematuria

Other injuries

Past history

Hypertension, diabetes, IHD, Tuberculosis, Asthma, Psychiatric illness, previous suicidal attempts.

Personal history

Alcohol

Smoking

Examination

General findings

Pallor

Jaundice

Pedal edema

Cyanosis

Breath smell of alcohol

Mental status

Other injuries

Vital signs

PR

BP

RR

Temperature

Systemic examination

Abdomen

Inspection

Site and number of injury

Organ injured

Bleeding

Flank haematoma or ecchymosis

Abdominal wall movement

Palpation

Tenderness

Guarding and rigidity

Percussion

Free fluid

Liver dullness obliteration

Auscultation

Bowel sounds

Per rectal examination

Other system examination

CVS

RS

CNS

provisional diagnosis

Investigations

Blood urea and sugar

Serum creatinine

Electrolytes

Blood grouping and typing

X-ray PA view

X-ray abdomen

CT scan of the abdomen

Treatment

Conservative management

Explorative laparotomy

- Findings
- Procedure done

Complication

- Immediate
- Delayed

MASTER CHART

MASTER CHART

Sl.No	Name	Age	sex	IP.no	DOA	instrument used	mode of injury	external site of injury	signs for mandatory laparotomy	peritoneal penetration by CT scan	visceral injuries in CT	injuries encountered during laparotomy	treatment offered	complications encountered
1	Thirunavukarasu kmc	16	Male	12597	6/13/2007	knife	homicide	epigastric region	absent	present	leakage of contrast in the peritoneum	laceration of transverse colon	primary suturing in double layer	nil
2	Nagavalli rmc	21	Female	878310	29--07-07	knife	homicide	epigastric region	present peritonitis	not done		gastric lessercuvature omentum laceration	gastric repair	nil
3	saravanan rmc	27	Male	879385	11--08-07	ironrod	homicide	epigastric region	absent	present	small hematoma of liver	laceration of liver with non expanding	non therapeutic laparotomy	nil
4	Govinthan kmc	32	Male	17718	11--08-07	knife	homicide	left lumbar	absent	present	small subcapsular hematoma of liver	not done	conservative management	nil
5	Dinesh karthick kmc	27	Male	17872	13--08-07	knife	homicide	epigastric region	present hemodynamic instability	not done		1.5 l hemoperitoneum, ant.post wall of stomach injury	gastric repair	nil
6	Saminathan rmc	28	Male	820294	23--08-07	knife	homicide	right hypochondrium	absent	present	intraparenchymal hematoma of liver	nonexpanding hematoma of liver	non therapeutic laparotomy	nil
7	Srinivasan kmc	40	Male	23985	26--10-07	knife	homicide	epigastric and rt iliac fossa	absent	present	minimal hemoperitoneum with small mesenteric hematoma	not done	conservative management	nil
8	Selvam rmc	32	Male	886536	23--11-07	broken glass	homicide	epigastric region	present peritonitis	not done		hemoperitoneum with laceration of stomach	gastric repair	nil
9	Ponnapan kmc	35	Male	25935	29--11-07	bull gore	accident	umblical region	present evisceration	not done		omental laceration	omentectomy	wound infection
10	Murugananthan kmc	26	Male	29331	1--1-08	knife	homicide	umblical region	present peritonitis	not done		jejunal laceration	primary suturing in double layer	nil
11	Ayyappan rmc	26	Male	888829	2--1-08	ironrod	homicide	left hypochondrium	absent	present	splenic hematoma with hemoperitoneum	same	splenectomy	respiratory complications

12	Mani rmc	35	Male	889702	17--01-08	knife	homicide	epigastric region	absent	present	extravasation of contrast	jejunal, ileal, mesenteric tear	primary suturing in double layer	nil
13	Aakash rmc	14	Male	889700	17--01-08	knife	homicide	left lumbar	absent	present	small hematoma of liver	not done	conservative management	nil
14	Yohesh rmc	28	Male	890055	20--01-08	knife	homicide	left lumbar	absent	present	no findings	delayed laparotomy sigmoid lacaration	colostomy	intraabdominal sepsis
15	Balasubramanian rmc	60	Male	890096	1/22/2008	knife	homicide	umblical region	absent	present	extravasation of contrast	jejunal laceration	primary suturing in double layer	wound infection
16	Lakshmi kmc	30	Female	3219	4--2-08	trocar	iatrogenic	umblical region	present evisceration	not done		omental contusion and laceration	omentectomy	nil
17	Nagammal kmc	38	Female	4187	22--3-08	broken glass	homicide	epigastric region	absent	present	extravasation of oral contrast	laceration of stomach and transverse colon	primary suturing in double layer	nil
18	Perumal rmc	29	Male	893131	4--3-08	knife	homicide	umblical region	absent	present	hemoperitoneum and extravasation of oral contrast	jejunal laceration	primary suturing in double layer	nil
19	Kuppammal kmc	50	Female	6941	2--4-08	knife	homicide	lt iliac fossa	absent	present	no findings	delayed laparotomy sigmoid lacaration	primary suturing in double layer	intraabdominal sepsis,faecal fistula
20	Ravikumar rmc	32	Male	7048	22--4-08	knife	homicide	epigastric region	absent	present	no findings	not done	conservative management	nil
21	Murugan kmc	30	Male	7541	11--5-08	knife	homicide	back	absent	absent		not done	conservative management	nil
22	Elumalai kmc	42	Male	7648	22--5-08	knife	homicide	rt Iliac fossa	absent	absent		not done	conservative management	nil
23	Gubendhran kmc	40	Male	7739	25--5-08	ironrod	homicide	rt loin	absent	absent		not done	conservative management	nil
24	Saravanan kmc	20	Male	7930	30--5-08	knife	homicide	epigastric region	absent	present	small subcapsular hematoma of liver and extravasation of contrast	grade 1 liver laceration and ileal laceration	primary suturing in double layer	nil
25	Ganapathy rmc	40	Male	901284	4--6--08	broken glass	accident	umblical region	absent	present	extravasation of contrast	jejunal tear	primary suturing in double layer	intraabdominal sepsis
26	Pindu kmc	19	Male	10568	22--6-08	knife	homicide	umblical region	present peritonitis	not done		ileal tear 2 in no. mesenteric hematoma	primary suturing in double layer	wound infection

27	Subburajan kmc	40	Male	10578	12--7-08	knife	self inflicted	umblical region	absent	absent		not done	conservative management	nil
28	Dhanalakshmi kmc	21	Female	13539	20--7-08	knife	homicide	epigastric region	present hemodynamic instability	not done		hemoperitoneum 2 l, laceration of stomach, liver, duodenum,pancreas,kidney	gastrojejunostomy done abdominal packing done, relook surgery no active	death
29	Chandra kmc	40	Female	13540	20--7-08	knife	homicide	epigastric, lt hypochondrium, lt lumbar	absent	present	no findings	not done	conservative management	nil
30	Murugan rmc	30	Male	902966	20--7-08	knife	homicide	lt loin	absent	present	extravasation of oral contrast	sigmoid and jejunal laceration	primary suturing in double layer	wound infection
31	Julius rmc	43	Male	931520	21--8--08	knife	homicide	lt loin	absent	present	no findings	not done	conservative management	nil
32	Perumal kmc	35	Male	18713	31--8-08	knife	homicide	lt loin	absent	present	hemoperitoneum and extravasation of oral contrast	hemoperitoneum 1l, sigmoid and ileal tear-multiple	primary suturing in double layer	nil
33	Palani rmc	27	Male	900609	1--9-08	knife	homicide	epigastric and umblical region	absent	present	free fluid, extravasation of contrast	gastric and transverse colon laceration	primary suturing in double layer	nil
34	Devan rmc	38	Male	908084	28--9-08	knife	homicide	lt groin	absent	absent		not done	conservative management	nil
35	Malayathri kmc	36	Male	21784	2--10-08	knife	homicide	umblical region	absent	present	extravasation of contrast	jejunal tear	primary suturing in double layer	wound infection
36	Abu becker rmc	4	Male	908534	26--10-08	broken glass	accident	umblical region	absent	absent		not done	conservative management	nil
37	Ravi kmc	40	Male	23664	18--11-08	knife	homicide	lt iliac fossa	absent	absent		not done	conservative management	nil
38	Ramesh rmc	38	Male	922102	18--11-08	knife	self inflicted	epigastric region	absent	absent		not done	conservative management	nil
39	Niraimathy kmc	28	Female	2173	7--1-09	knife	homicide	umblical region	absent	present	extravasation of contrast	jejunal tear	primary suturing in double layer	nil
40	Pandiyan rmc	36	Male	925154	12--2-09	knife	homicide	umblical region	absent	present	free fluid, extravasation of contrast	jejunal tear	resection and anastamosis	nil
41	Rajan rmc	25	Male	927183	29--3-09	knife	homicide	epigastric region	absent	present	free fluid, extravasation of contrast	gastric laceration	primary suturing in double layer	wound dehiscence
42	Baskar rmc	28	Male	927614	2--4-09	knife	homicide	suprapubic	absent	present	free fluid, extravasation of contrast	ileal tear 2 in no. mesenteric hematoma	primary suturing in double layer	nil

43	Munusamy rmc	27	Male	928384	14--4-09	knife	homicide	umblical region	absent	present	extravasation of contrast	jejunal tear	primary suturing in double layer	nil
44	Mohan rmc	38	Male	929180	30--4-09	knife	homicide	epigastric region	absent	present	extravasation of oral contrast	stomach laceration	primary suturing in double layer	nil
45	Sivakumar kmc	29	Male	10011	9--5-09	broken glass	accident	epigastric region	absent	absent		not done	conservative management	nil
46	Subramani kmc	45	Male	12816	20--5-09	knife	homicide	rt Iliac fossa	absent	absent		not done	conservative management	nil
47	Babu rmc	50	Male	932903	23-5--09	knife	homicide	umblical region	absent	present	mesenteric hematoma	bleeding mesenteric hematoma with tear	tear closed hemostasis secured	nil
48	Sarathy rmc	36	Male	933024	2--6-09	knife	homicide	epigastric region	absent	present	eatravasation of oral contrast	gastric laceration	primary suturing in double layer	nil
49	kodeeshwar kmc	40	Male	13521	18--6-09	knife	homicide	lt hypochondrium	absent	present	small splenic hematoma	not done	conservative management	nil
50	Jagadeesan kmc	25	Male	13761	22--6-09	knife	homicide	lt loin, back, lt scapula	absent	present	no findings	not done	conservative management	nil
51	Madavan kmc	40	Male	14049	22--6-09	broken glass	homicide	rt hypochondrium, rt lumbar	absent	present	hemoperitoneum	not done	conservative management	nil
52	Ayyammal kmc	40	Female	14390	28--6-09	knife	homicide	epigastric region	absent	present	extravasation of oral contrast	stomach laceration	primary suturing in double layer	nil
53	Babu kmc	32	Male	14581	2--7-09	knife	homicide	epigastric region	absent	present	hematoma of liver and extravasation of contrast	liver 6th segment laceration, jejunal and transverse colon tear	primary suturing in double layer	nil